Client	**AREVA T&D S.p.A.** **Noventa di Piave (VE) – ITALY**
Equipment under test	One pole of outdoor 362 kV horizontal disconnector with associated earthing switch
Tests performed	Operation under severe ice conditions (20 mm ice coating)
Normative documents	IEC 62271-102, 2003
Receipt date of the sample	January 12, 2004
Test date	**from** January 21, 2004 **to** January 30, 2004

The test results relate only to the sample tested.

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No. of pages	21	**No. of pages annexed**	12
Issue date	February 12, 2004		
Prepared	PeC – R. Mariani		
Verified	PeC – P. Gramaglia		
Approved	PeC – V. Scarioni		

CESI
CENTRO ELETTROTECNICO SPERIMENTALE ITALIANO
Business Unit
Prove e Componenti
Il Responsabile del Laboratorio

Test witnessed by Mr. F. Zanchetta (AREVA T&D S.p.A.)
Mr. S. Serafin (AREVA T&D S.p.A.)

Measurement uncertainties
The measurement uncertainties of the test results reported in this document are the following:

voltage: ± 5 % **current: ± 5 %** **time: ± 5 %**

The measurement uncertainties are estimated at the level of twice the standard deviation (corresponding, in the case of normal distribution, to a confidence level about 95 %) and have to be considered as maximum values.

Identification of the tested object
The Manufacturer guarantees that the tested object is manufactured according to the submitted drawings. CESI checked that these drawings adequately represent in shape and dimensions the essential details and the parts of the tested object.
These drawings identified by CESI and numbered A4/003721 no. 1 to 8 have been returned to the Client.

Test results
The apparatus has been operated on the first attempt up to its final closed and open position by the operating device supplied at its rated voltage.
The resistance of the main current path did not show significant change.
The check of the galvanic contact immediately after the closing operation has been carried out positively.

Laboratory information

CESI testing team Mr. M. Bonalumi
Mr. A. Bresciani
Mr. R. Scarabattola
Mr. P. Settimio

Test laboratory CT443

Activity code: 40148Y

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1 RATED CHARACTERISTICS OF THE TESTED OBJECT ASSIGNED BY THE MANUFACTURER

Test object	**One pole of outdoor 362 kV horizontal disconnector**
Manufacturer	AREVA T&D S.p.A. – ITALY
Type	S2DAT
Mechanical endurance class	M2
Rated voltage	362 kV
Normal current	2000 A
Frequency	50 Hz
Lightning impulse withstand voltage	1175 kV
Switching impulse withstand voltage	950 kV
Power frequency withstand voltage	450 kV
Short-time withstand current	50 kA
Peak withstand current	125 kA
Short-circuit duration	3 s
Total duration of operation	15 s
Mechanical terminal load ($F_a/F_b/F_c$)	1000 N/ 330 N/ 1250 N

Test object	**earthing switch**
Manufacturer	AREVA T&D S.p.A.
Type	STB 50
Making capability class	E
Rated voltage	362 kV
Frequency	50 Hz
Lightning impulse withstand voltage	1175 kV
Switching impulse withstand voltage	950 kV
Power frequency withstand voltage	450 kV
Short-time withstand current	50 kA
Peak withstand current	125 kA
Short-circuit duration	3 s
Operating mechanism	
Type	CMM
Supply voltage	
closing device	230 $V_{A.C.}$
opening device	230 $V_{A.C.}$
motor	400 $V_{A.C.}$
peak power	0,22 kW

2 LIST OF INSTRUMENTS USED FOR THE TEST

Current measurement of control circuit:
KoCoS PBA 2000 System, CESI number 022338

Current measurement of motor:
KoCoS PBA 2000 System, CESI number 022338

Voltage measurement of motor:
KoCoS PBA 2000 System, CESI number 022338

Resistance measurement:

Microohmmeter MOH 600 A CESI number 14204

3 MISCELLANEOUS INFORMATION FOR THE TEST

3.1 Set up of the tested object

The test object has been set up in the 800 m^3 climatic cell, as in service conditions and fixed on a platform.

3.2 Modality of measurement of quantities during tests

For the measurement of the quantities during the tests, the following rules have been applied:

- the current in the motor of the operating mechanism is measured as follows:
- peak current as the starting maximum current;
- steady state current as mean value measured after the peak current;
- the two voltage probes used for calculation of the resistance, were connected to the two terminals of the disconnector and connected to the nearest reacheble point with respect to main contacts.

3.3 Identification of the signals contained in the oscillograms

Channel no.	signal
1	current in the opening and closing coils
2	current in the motor
3	main contact
4	auxiliary contacts

4 MECHANICAL OPERATION TESTS UNDER SEVERE ICE CONDITIONS

Tested object: line disconnector, new conditions

Type of test: mechanical operations before the tests

Ambient air temperature: 5° C

Date: January 21, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			coil	motor	current	duration of impulse command	current		duration of operation	A	B	C	concord	discord
							Peak	steady state						
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
1	1	C	230	400	150	17,0	3,12	0,44	10,4	8,42	-	-	10,09	0,82
2	2	O	230	400	160	18,9	3,18	0,77	10,4	2,25	-	-	0,55	9,82
3	-	C	230	400	130	20,4	2,24	0,44	10,4	8,42	-	-	10,09	0,84
4	-	O	230	400	190	17,7	4,25	0,72	10,4	2,29	-	-	0,60	9,86
5	-	C	230	400	176	18,5	2,54	0,44	10,4	8,39	-	-	10,09	0,84
6	-	O	230	400	180	22,0	1,80	0,49	10,4	2,26	-	-	0,59	9,87
7	-	C	230	400	168	21,2	2,04	0,45	10,4	8,44	-	-	10,12	0,85
8	-	O	230	400	180	17,8	4,31	0,75	10,4	2,27	-	-	0,58	9,85
9	-	C	230	400	161	16,7	3,40	0,45	10,4	8,43	-	-	10,12	0,85
10	-	O	230	400	170	18,0	3,95	0,77	10,4	2,32	-	-	0,60	9,86

C = closing operation O = opening operation

Tested object: earthing switch, new conditions

Type of test: mechanical operations before the tests

Ambient air temperature: 5° C

Date: January 21, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			coil	motor	current	duration of impulse command	current		duration of operation					
							Peak	steady state		A	B	C	concord	discord
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
1	3	C	230	400	168	18,8	5,75	0,88	7,7	7,16	-	-	7,10	0,69
2	4	O	230	400	170	19,2	4,01	0,77	8,1	1,64	-	-	1,41	7,69
3	-	C	230	400	183	18,2	5,80	0,40	7,7	7,16	-	-	7,10	0,70
4	-	O	230	400	210	19,7	4,12	0,55	8,1	1,64	-	-	1,41	7,69
5	-	C	230	400	176	19,7	4,20	0,47	7,7	7,16	-	-	7,10	0,69
6	-	O	230	400	180	17,8	4,35	0,47	8,1	1,63	-	-	1,41	7,69
7	-	C	230	400	161	19,7	3,89	0,55	7,7	7,16	-	-	7,10	0,70
8	-	O	230	400	180	22,4	4,01	0,47	8,0	1,63	-	-	1,41	7,69
9	-	C	230	400	168	22,0	5,44	0,47	7,7	7,13	-	-	7,10	0,70
10	-	O	230	400	170	20,5	3,73	0,47	8,1	1,64	-	-	1,41	7,69

C = closing operation O = opening operation

Tested object: line disconnector

Type of test: mechanical operation under severe ice conditions (20 mm)

Ambient air temperature: -7 °C

Date: January 22, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
					current	duration of impulse command	current		duration of operation					
			Coil	motor			Peak	steady state		A	B	C	concord	discord
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
11	5	O	230	400	200	21,2	2,54	0,58	10,5	2,54	-	-	0,58	9,94

C = closing operation O = opening operation

Tested object: earthing switch

Type of test: mechanical operation under severe ice conditions (20 mm)

Ambient air temperature: -7 °C

Date: January 22, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
					current	duration of impulse command	current		duration of operation					
			Coil	motor			peak	steady state		A	B	C	concord	discord
No.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
11	6	C	230	400	190	15,9	5,19	0,61	7,9	7,30	-	-	7,24	0,82

C = closing operation O = opening operation

Tested object: line disconnector

Type of test: mechanical operation under severe ice conditions (20 mm)

Ambient air temperature: -7 °C

Date: January 28, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			Coil	motor	current	duration of impulse command	current		duration of operation	A	B	C	concord	discord
							Peak	steady state						
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
12	7	C	230	400	190	15,7	5,19	0,44	7,9	7,30	-	-	7,24	0,82

C = closing operation O = opening operation

Tested object: earthing switch

Type of test: mechanical operation under severe ice conditions (20 mm)

Ambient air temperature: -7 °C

Date: January 28, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			Coil	motor	current	duration of impulse command	current		duration of operation	A	B	C	concord	discord
							peak	steady state						
No.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
12	8	O	230	400	190	18,2	5,44	0,55	7,8	1,55	-	-	0,93	7,39

C = closing operation O = opening operation

Tested object: line disconnector

Type of test: mechanical operations after the tests

Ambient air temperature: 5° C

Date: January 29, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			coil	motor	current	duration of impulse command	current		duration of operation	A	B	C	concord	discord
							Peak	steady state						
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
13	9	C	230	400	198	20,5	2,46	0,58	10,4	8,46	-	-	10,16	0,82
14	10	O	230	400	200	17,0	7,18	0,69	8,2	1,88	-	-	1,31	7,76
15	-	C	230	400	168	15,1	3,37	0,55	10,5	8,50	-	-	10,19	0,84
16	-	O	230	400	180	16,3	6,99	0,75	8,2	1,88	-	-	1,32	7,76
17	-	C	230	400	183	17,1	2,79	0,83	10,5	8,49	-	-	10,16	0,87
18	-	O	230	400	180	18,9	5,97	0,61	8,2	1,87	-	-	1,32	7,77
19	-	C	230	400	183	15,9	2,46	0,61	10,5	8,49	-	-	10,16	0,86
20	-	O	230	400	190	19,0	3,34	0,65	8,2	1,87	-	-	1,32	7,77
21	-	C	230	400	190	18,9	2,87	0,83	10,5	8,50	-	-	10,21	0,87
22	-	O	230	400	180	20,4	4,17	0,61	8,2	1,87	-	-	1,33	7,75

C= closing operation O= opening operation

Tested object: earthing switch

Type of test: mechanical operations after the tests

Ambient air temperature: 5° C

Date: January 29, 2004

Test	Oscill.	Type of operation	Voltage of operating devices and control circuit		Coil		Motor			Operation time of main contact			Operation time of auxiliary contact	
			coil	motor	current	duration of impulse command	current		duration of operation	A	B	C	concord	discord
							Peak	steady state						
no.	no.	-	[$V_{a.c.}$]	[$V_{a.c.}$]	[mA]	[ms]	[A]	[A]	[s]	[s]	[s]	[s]	[s]	[s]
13	11	C	230	400	183	21,2	4,78	0,69	7,8	7,00	-	-	7,16	0,83
14	12	O	230	400	200	16,7	7,18	0,72	8,2	1,88	-	-	1,31	7,76
15	-	C	230	400	176	21,6	3,70	0,61	7,8	7,03	-	-	7,19	0,67
16	-	O	230	400	180	16,3	6,99	0,68	8,2	1,88	-	-	1,32	7,76
17	-	C	230	400	168	22,0	5,11	0,64	7,8	7,03	-	-	7,18	0,66
18	-	O	230	400	180	21,2	5,97	0,64	8,2	1,87	-	-	1,32	7,77
19	-	C	230	400	161	18,9	5,86	0,61	7,7	7,03	-	-	7,18	0,66
20	-	O	230	400	190	20,4	3,34	0,63	8,2	1,87	-	-	1,32	7,75
21	-	C	230	400	205	21,2	4,45	0,61	7,8	7,03	-	-	7,19	0,68
22	-	O	230	400	180	16,3	4,17	0,61	8,2	1,87	-	-	1,32	7,77

C= closing operation O= opening operation

5 VERIFICATIONS AFTER THE TESTS

5.1 Measurement of the resistance of main current path

The main circuit resistance measurement has been performed with 100 $A_{d.c.}$

Tested object: disconnector

Conditions	Temperature of climatic cell [°C]	Resistance A [μΩ]	B [μΩ]	C [μΩ]
Before the test: January 21, 2004	5	138	-	-
After the test: January 30, 2004	5	145	-	-

Tested object: earthing switch

Conditions	Temperature of climatic cell [°C]	Resistance A [μΩ]	B [μΩ]	C [μΩ]
Before the test: January 21, 2004	5	264	-	-
After the test: January 30, 2004	5	293	-	-

5.2 Check of the galvanic contact

The check of the galvanic contact immediately after the closing operation has been carried out positively.

6 TESTED OBJECT PICTURES

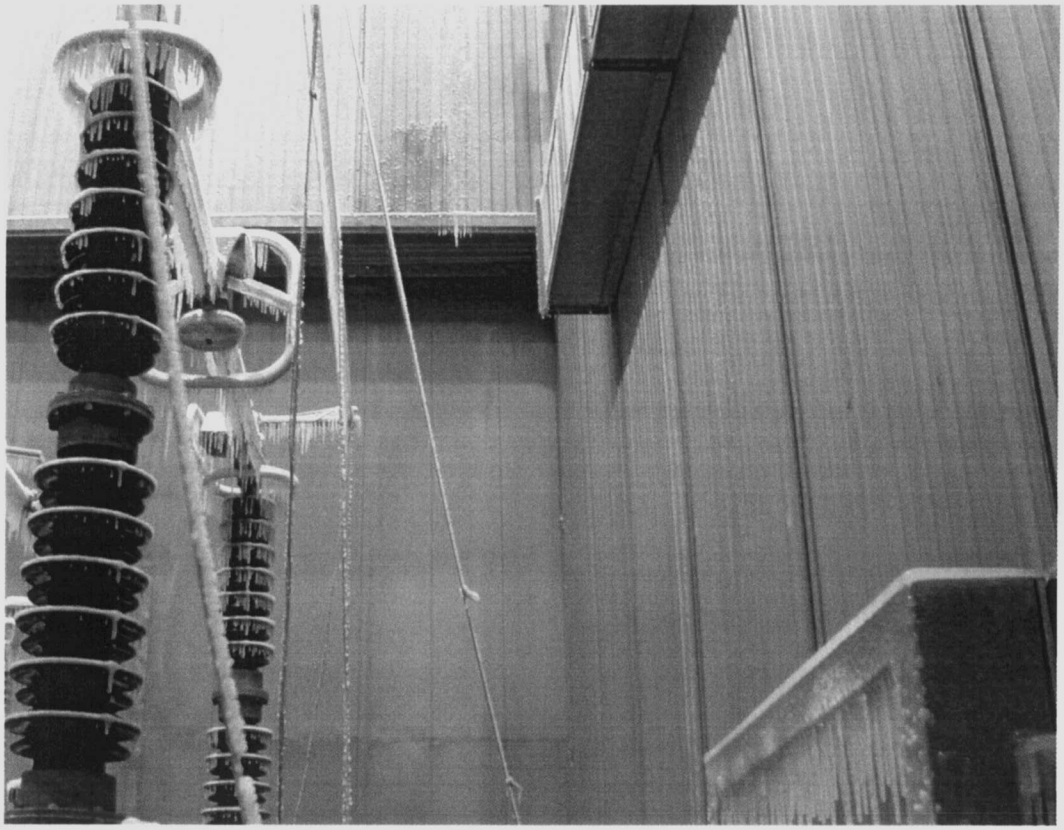


Photo no. 1

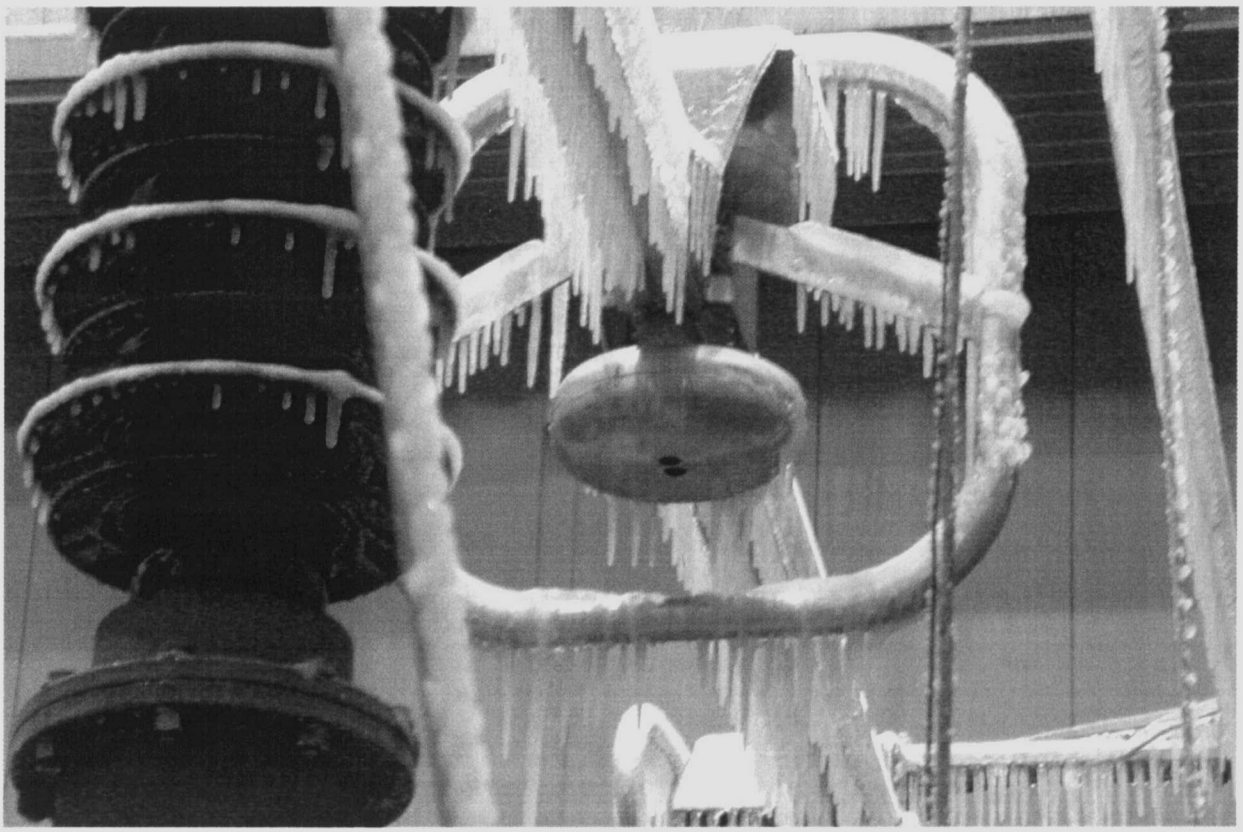
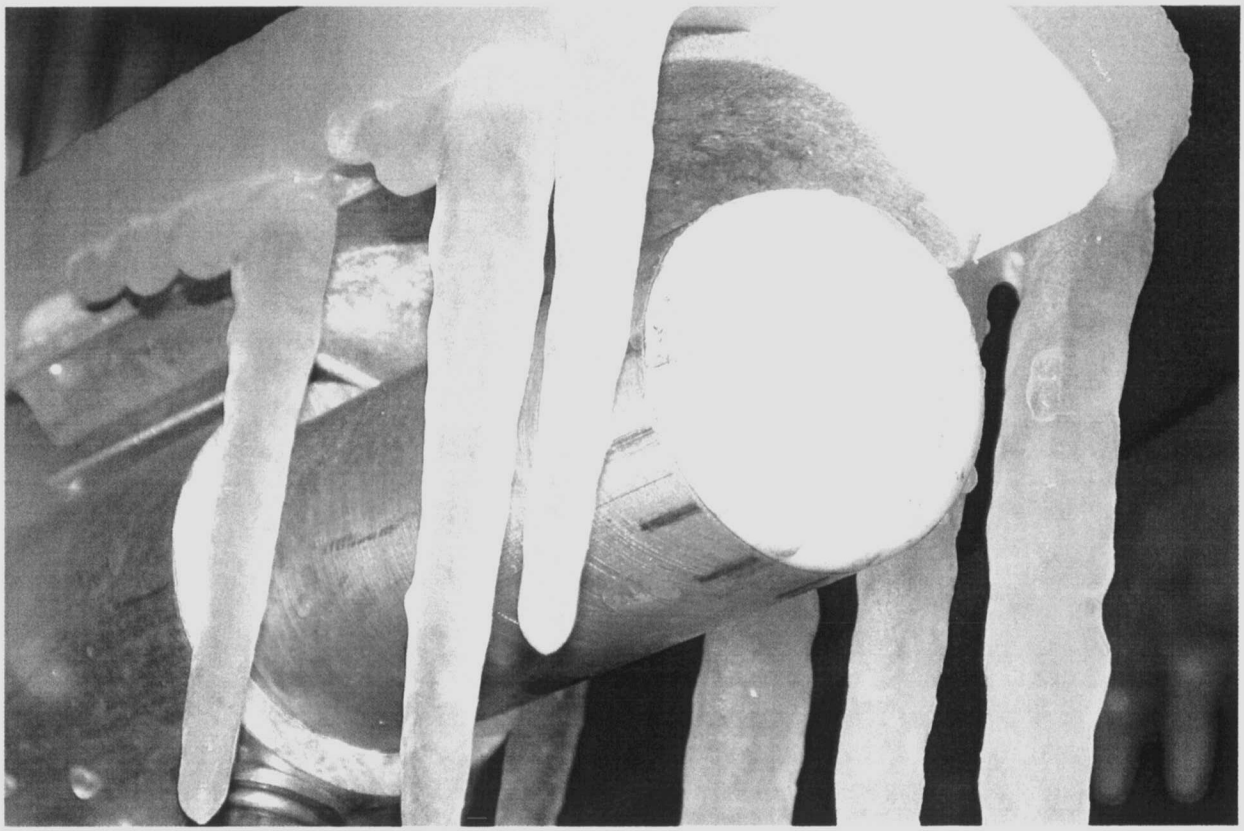


Photo no. 2

Photo no. 3



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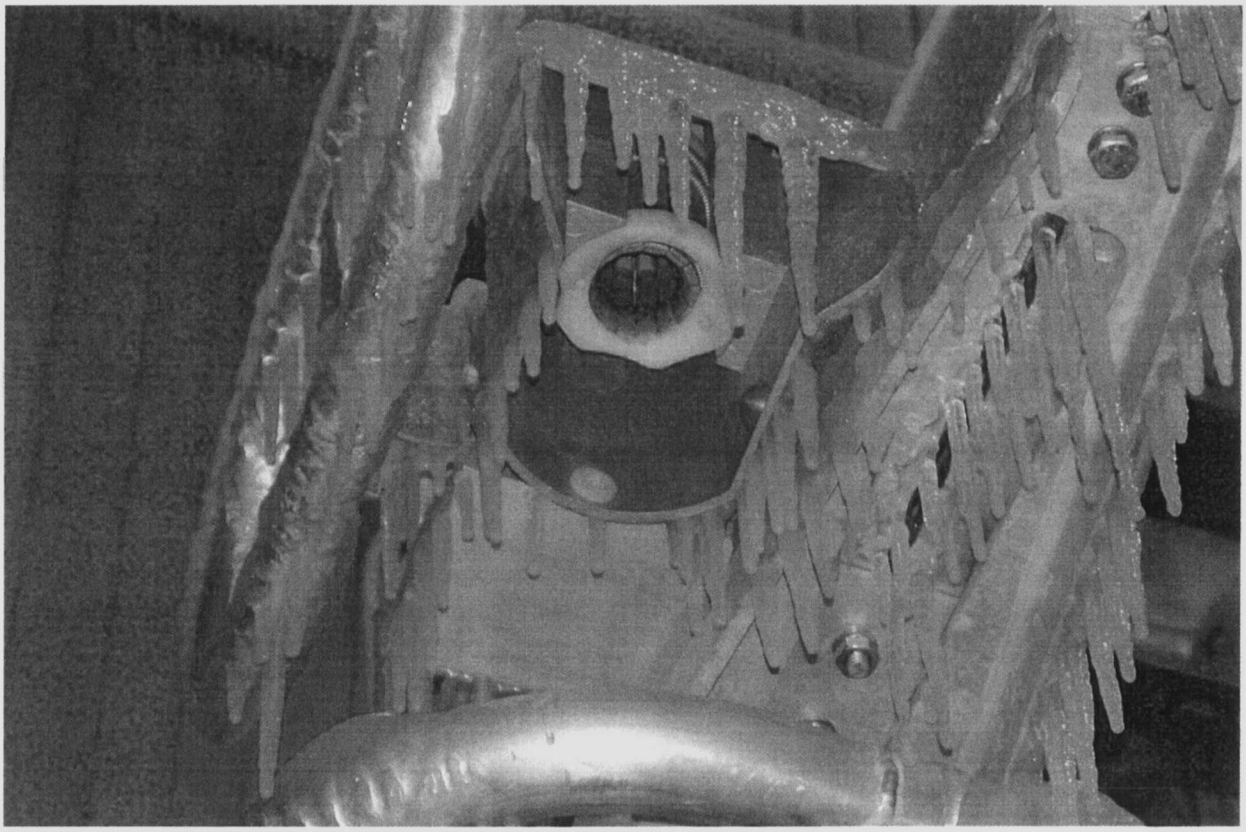

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Photo no. 6

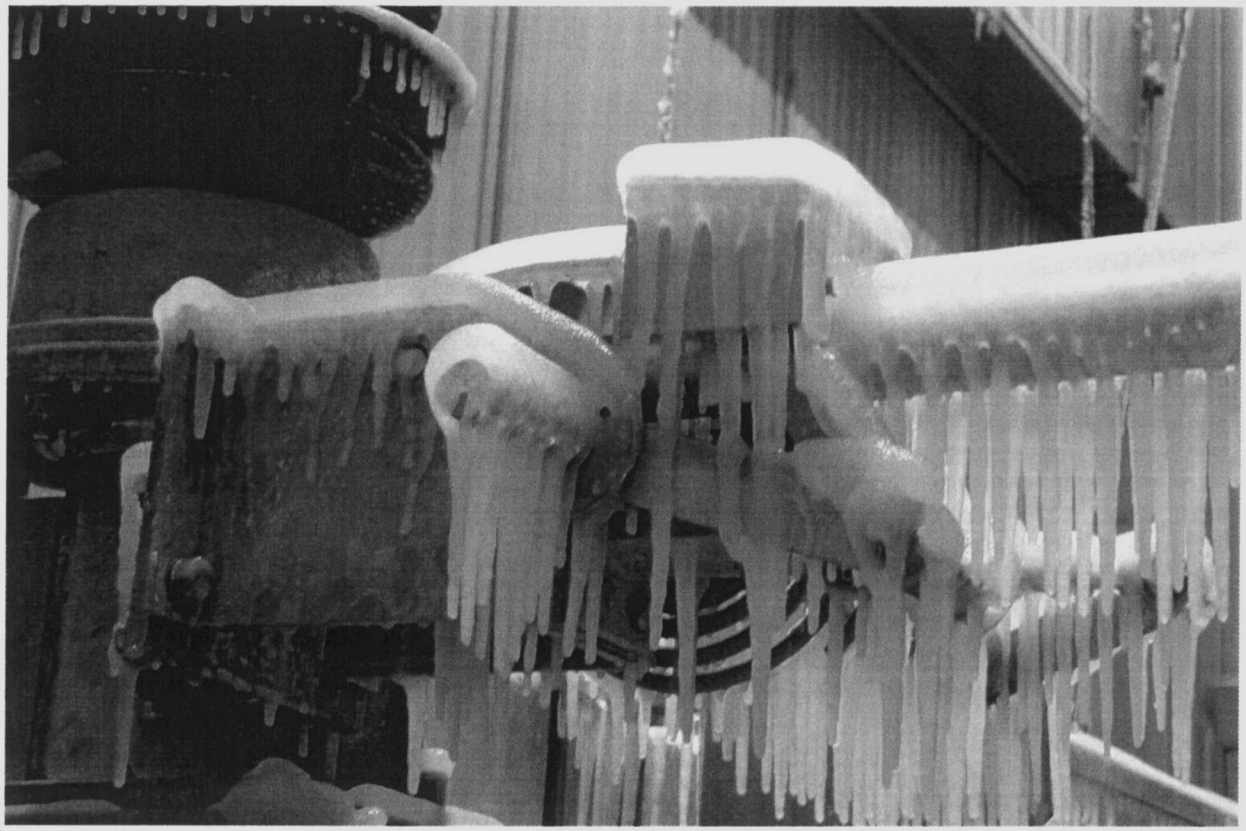

Photo no. 7